REMARKS

The specification and claims have been carefully reviewed in the light of the office action to which this amendment is responsive. An effort has been made to address each of the matters raised by the Examiner.

Formal Objections

With respect to the Information Disclosure Statement, a replacement Information Disclosure Statement and PTO Form 1449 are enclosed providing the correct information for the two non-patent literature documents.

An application data sheet showing the city and country of residence of the inventors is filed herewith.

With regard to the objection that items 1 and 2 on page 7, lines 2-4 of the Specification are not shown in the figures, it is noted that the items referred to are those enumerated at lines 20 and 28 on page 6. No correction is therefore believed to be required.

An abstract is filed herewith.

Finally, with respect to priority, consistent with the telephone discussion with the Examiner today, for the sake of completeness, a copy of the PCT office as filed is enclosed herewith.

Objections to the Claims

Applicant files herewith an amended set of claims. Claims 10, 14, 15 and 18 have been amended to overcome the examiner's objections. Claims 11, 13 and 16 have been deleted, and a consequential amendment has been made to claim 12.

Claims 10, 14, 15 and 18 now include the features of claims 11 and 13, in order to ensure that they are fully distinguished from the prior art, and as explained in more detail below.

The invention relates to an apparatus for and a method of data classification of unknown items, using a training set of classified examples.

The aim of the invention is not only to predict a classification for an unknown item, but also to provide a measure of confidence in that classification, valid under the iid

assumption (that is, the assumption that the training and unknown examples are generated from the same distribution).

As defined in amended claim 10, the data classification apparatus comprises an input device for receiving training classified examples and at least one unclassified example, a memory for storing the examples, an output terminal for outputting a predicted classification for the unclassified example and a processor for identifying the predicted classification, where the processor includes classification allocation means for allocating potential classifications to each unclassified example and for generating a plurality of classification sets, each set containing the plurality of training classified examples with their classification and at least one unclassified example with its allocated potential classification, an assay means including an example valuation device to determine individual strangeness values for each training classified example and at least one unclassified example, the assay means determining an overall strangeness value valid under the iid assumption for each classification set in dependence on the individual strangeness values, a comparative device for selecting the classification set to which the most likely potential classification for the unclassified example belongs on the basis of the overall strangeness values assigned by the assay means, and a strength of prediction monitoring device for determining a confidence value for the predicted classification on the basis of the overall strangeness value assigned to the classification set to which the second most likely potential classification of the unclassified example belongs.

Thus, the apparatus starts with training classified examples, and uses these to predict the classification of an unclassified example. The classification allocation means allocates potential classifications to each unclassified example, and generates a number of classification sets, each containing the training examples with their classification, and at least one unclassified example with a potential classification. Each pair, of the example and classification, in the set is tested by the assay means to determine its individual strangeness value (that is, a measure of how strange it would be if the classification were correct). The assay means determines an overall strangeness value, valid under the iid assumption, for each classification set, in dependence on the individual strangeness values. The comparative device compares the overall strangeness values for all the sets, to see which is the most likely to be correct for the unclassified example. The strength of prediction monitoring device then looks at the second most likely classification (on the basis of the overall strangeness values), to give a measure of confidence that the most likely classification is in fact correct. Thus, the greater the difference between the overall

strangeness values of the most likely potential classification and the second most likely potential classification, the greater is the measure of confidence that the most likely classification is correct.

We submit that this combination of features is not shown in any of the prior art documents.

US 5,577,166 of Mizuno shows a method and apparatus for classifying an input pattern. It starts with training patterns, and measures their distribution in terms of an average, a standard deviation and minimum and maximum values. It then classifies an unknown pattern by looking at how similar it is to a training pattern. It stores the classification assigned to the unknown pattern, and then a correct classification, and calculates the error between them. When the average error exceeds a predetermined value, re-training takes place. In general, this patent does not aim to complement predictions of classification with valid measures of confidence, but instead to cope with the possibility that the unknown patterns are generated by a different mechanism from the training patterns (see column, lines 9-19). This differs from the invention as claimed, which specifies that the strangeness value is valid under the iid assumption, that is, that the unknown and training examples are generated from the same distribution. It is submitted that the steps described in Mizuno, column 9, lines 14-26 do not show the determination of an individual strangeness value for each training example and an unknown example, and then the determination of an overall strangeness value for each classification set, in dependence on the individual strangeness values. Further, Mizuno does not show a comparative device for selecting the most likely potential classification. Instead, it computes the average error, which does not provide a confidence value for the most likely classification, on the basis of the overall strangeness value of the second most likely potential classification.

It is submitted therefore that claim 10 is clearly novel over Mizuno.

Further, Mizuno does not show or suggest determining a strangeness value valid under the iid assumption, and indeed is concerned with the possibility that the unknown patterns are generated from a different distribution, rather than the same distribution. Thus, Mizuno teaches away from the invention, rather than towards it. Further, Mizuno does not show or suggest determining individual strangeness values and then an overall strangeness value. It is therefore submitted that claim 10 is clearly inventive in view of Mizuno.

Of the remaining prior art, US 5,640,492 of Cortes does show the use of Lagrange multipliers for determining strangeness values, but otherwise does not provide any measure of confidence in the predicted classification. This is indicated on page 1 of the specification.

It is believed that the remaining prior art is not relevant to the present invention. It is noted that GB 2,369,899 was published after the priority and filing dates of the present application, and so does not appear to be a correct citation.

Applicant submits therefore that claim 10 is clearly distinguished from all the prior art; and is therefore allowable. Claims 14, 15 and 18 have the same limitations as claim 10, and it is therefore submitted that these are also allowable.

As claims 12 and 17 are dependent on claims 10 and 15, it is submitted that these are allowable to the same extent.

Hence, it is believed that the claims as now presented all patentably distinguish over the prior art so as to be in condition for allowance. Accordingly, an early action to that effect is respectfully requested.

Respectfully submitted,

Dennis R. Schlemmer, Reg. No. 24,703
LEYDIG, VOIT & MAYER, LTD.
Two Prudential Plaza, Suite 4900
180 North Stetson Avenue
Chicago, Illinois 60601-6780
(312) 616-5600 (telephone)
(312) 616-5700 (facsimile)

Date: March 15, 2004